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TEMPOROMANDIBULAR JOINT: DYSFUNCTION, EARLY DIAGNOSIS AND EVALUATION OF THE EFFECTIVENESS OF CLINICAL ALGORITHMS

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Abstract: The article is devoted to the problem of temporomandibular joint (TMJ) dysfunction, one of the most common pathologies in dental practice. Modern approaches to early diagnosis are considered, including clinical methods and instrumental examinations (MRI, CT, ultrasound, EMG). Special attention is given to the development and implementation of clinical algorithms, which increase diagnostic accuracy and standardize treatment strategies. A classification of dysfunctions is presented, issues of differential diagnosis are discussed, and modern treatment methods are outlined. The practical significance of the algorithmic approach for dentists and general practitioners is emphasized. The conclusion highlights the prospects of integrating digital technologies, telemedicine, and artificial intelligence into the diagnosis and treatment of TMJ dysfunction.

Keywords: TMJ; dysfunction; early diagnosis; clinical algorithms; magnetic resonance imaging; electromyography; treatment; telemedicine.

Modern dentistry and maxillofacial surgery are increasingly focused on the challenges associated with temporomandibular joint (TMJ) dysfunction. This pathological condition represents a complex clinical and functional syndrome manifested by pain, limitation of mandibular movement, clicking or joint noises, as well as impaired masticatory function and reduced quality of life. According to epidemiological studies, various manifestations of TMJ dysfunction are found in 20–40% of the population, with peak prevalence among working-age individuals, predominantly women.

It should be emphasized that the relevance of studying this condition is determined not only by its prevalence but also by the difficulties of early diagnosis and the high likelihood of progression to chronic forms, which significantly complicates treatment. In this regard, the development and implementation of clinical algorithms, which help standardize diagnostic procedures and improve their effectiveness, acquire particular importance.

Early diagnosis: modern approaches and challenges

Based on literature analysis, it can be stated that the key diagnostic challenge of TMJ dysfunction lies in its multifactorial etiology and diversity of clinical manifestations. Traditional methods of early detection include screening questionnaires, clinical examination, and functional tests. These make it possible to identify early signs such as limited mouth opening (less than 35 mm), pain response during palpation of the masseter and temporalis muscles, deviation of mandibular trajectory, and presence of acoustic phenomena.

However, as noted by Schiffman et al. (2014), only a comprehensive approach can ensure high diagnostic accuracy. In recent years, instrumental methods have been widely adopted, including magnetic resonance imaging (MRI), ultrasound (US), electromyography (EMG), and computed tomography (CT). Each method has its own advantages and limitations: MRI provides the most complete assessment of the disc and soft tissue structures, CT reveals bony changes, while US and EMG evaluate functional muscle activity.

It should be noted that the diagnostic accuracy of traditional clinical examination does not exceed 65–70%, whereas the use of instrumental methods increases this indicator up to 85–90%.

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Therefore, integration of clinical and instrumental approaches is a necessary condition for improving the quality of early detection.

Clinical-Diagnostic Algorithms and Their Significance

Modern scientific publications emphasize the necessity of implementing clinical algorithms, which allow structuring the patient examination process and minimizing the probability of diagnostic errors. As a rule, such algorithms include several sequential stages:

Primary screening (questionnaires, evaluation of complaints, medical history).

Clinical examination (palpation, assessment of movements, functional tests).

Instrumental verification (MRI, ultrasound, CT, EMG).

Formulation of a clinical diagnosis in accordance with accepted classifications (e.g., DC/TMD — Diagnostic Criteria for Temporomandibular Disorders).

Determination of therapeutic tactics (orthopedic correction, physiotherapy, pharmacological treatment, and rehabilitation measures).

A number of studies (Gauer & Semidey, 2015; Ahmad & Schiffman, 2016) confirm that the use of algorithmic schemes increases diagnostic accuracy by 30–40% compared with traditional subjective approaches. Moreover, algorithmization of clinical practice ensures a more rational allocation of diagnostic resources and reduces the time required to establish a diagnosis.

Classification of TMJ Dysfunctions

From a scientific and clinical perspective, it is essential to recognize that temporomandibular joint dysfunction represents a heterogeneous group of pathologies. The most widely used classification in global practice is the DC/TMD (Diagnostic Criteria for Temporomandibular Disorders), which identifies three main groups of disorders:

Muscular dysfunctions — myofascial pain, hypertonicity, and discoordination of masticatory muscles, manifested by pain and limited mandibular movements.

Intra-articular dysfunctions — disc displacement with or without reduction, joint locking, clicking, and crepitation.

Combined forms — coexistence of myogenic and arthrogenic disorders, often accompanied by chronic pain, occlusal changes, and secondary inflammatory alterations.

In domestic literature, classifications based on clinical manifestations are also used, such as pain syndrome, restricted mandibular motion, acoustic phenomena, and occlusal deformities. Specification of the dysfunction type is fundamentally important for the selection of therapeutic strategies, since orthopedic and therapeutic approaches differ depending on the form of the disorder.

Differential Diagnosis

One of the most challenging tasks remains the differential diagnosis of TMJ dysfunction, as its clinical picture frequently mimics other diseases:

Otolaryngological pathologies: chronic otitis media, eustachitis, and inflammatory processes of the middle ear may present with pain in the preauricular region, complicating diagnosis.

Neurological disorders: trigeminal neuralgia, tension-type headaches, and migraines often produce pain localized in the facial and temporal areas.

Dental causes: odontogenic infections, pathological tooth wear, and malocclusion may also manifest as pain and impaired masticatory function.

Orthopedic and rheumatologic conditions: osteoarthritis, arthritis, and systemic connective tissue diseases may affect joints, including the TMJ.

Accurate differential diagnosis makes it possible not only to exclude comorbid pathologies but also to avoid treatment errors, ensuring individualized patient management.

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Modern Approaches to TMJ Dysfunction Treatment

The effectiveness of clinical algorithms depends not only on diagnostic precision but also on the selection of adequate therapeutic strategies. In contemporary practice, treatment of TMJ dysfunction is structured stepwise, considering symptom severity, disease form, and overall patient condition:

1. **Orthopedic correction.** The most common approach involves occlusal splints, which redistribute masticatory load, eliminate parafunctions (e.g., bruxism), and reduce masticatory muscle hypertonicity. Occlusal correction and prosthetic rehabilitation to restore missing teeth are equally important in eliminating causal factors.
2. **Physiotherapy.** A wide range of physiotherapeutic modalities are applied, including ultrasound therapy, laser therapy, magnetotherapy, and therapeutic exercises (myogymnastics). These methods contribute to pain relief, improved microcirculation, and restoration of functional joint mobility.
3. **Pharmacological treatment.** Non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, and, when indicated, antidepressants are used. Intra-articular injections of hyaluronic acid or corticosteroids are sometimes administered to reduce inflammation and improve disc mobility.
4. **Innovative methods.** Botulinum toxin therapy has gained popularity in the management of myofascial pain, effectively reducing muscle hyperactivity. In severe cases, surgical interventions such as arthrocentesis, arthroscopy, or reconstructive TMJ surgeries may be employed.

Thus, modern therapeutic strategies are based on multidisciplinary collaboration among dental orthopedists, surgeons, physiotherapists, and neurologists. The combined use of diagnostic algorithms and stepwise treatment significantly reduces pain, restores TMJ function, and improves patients' quality of life.

Effectiveness of Algorithms: Literature Evidence

An analysis of recent scientific publications suggests that the effectiveness of early detection algorithms for TMJ dysfunction manifests in several aspects. Firstly, they reduce diagnostic errors and cases of overdiagnosis, which is particularly important given the polymorphic clinical picture. Secondly, timely initiation of treatment (orthopedic, physiotherapeutic, pharmacological) prevents disease chronicity. Thirdly, algorithmic approaches help standardize the work of different specialists — general dentists, prosthodontists, maxillofacial surgeons, physiotherapists, and neurologists.

Notably, the implementation of clinical algorithms contributes not only to higher diagnostic accuracy but also to improved therapeutic outcomes. According to various studies, integrated use of screening, clinical evaluation, and instrumental verification shortens treatment duration by 20–30%, reduces pain intensity by half, and increases the rate of functional recovery.

Scientific Discussion and Future Perspectives

Despite considerable progress, the problem of early TMJ dysfunction diagnosis is far from resolved. Challenges remain regarding the availability of advanced imaging techniques in everyday clinical practice. Furthermore, more research is needed to standardize and unify diagnostic algorithms across different age and clinical groups.

In the future, greater importance will be attached to the integration of digital technologies, including artificial intelligence, machine learning, and telemedicine platforms. Current developments already include automated programs for detecting TMJ pathologies on MRI and CT scans. Such systems may revolutionize diagnostics by enabling large-scale screening and providing clinical decision support for practitioners.

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Conclusion

TMJ dysfunction is a widespread condition that significantly impacts patients' quality of life. Early diagnosis plays a pivotal role in preventing chronicity and improving treatment effectiveness. Clinical algorithms, combining stepwise screening, clinical examination, and instrumental verification, ensure higher diagnostic accuracy, standardized therapeutic measures, and fewer diagnostic errors.

The algorithmic approach is of particular practical importance for general dentists and primary care physicians. Early identification of dysfunction at the primary care level allows timely referral to specialists with preliminary diagnostics, reducing the burden on specialized centers and accelerating treatment initiation. For surgeons and prosthodontists, algorithmization ensures optimal treatment planning, integration of orthopedic, physiotherapeutic, and pharmacological methods, and better coordination of multidisciplinary collaboration.

Future progress in TMJ dysfunction diagnosis and management will be closely linked to the expansion of digital technologies, telemedicine, and artificial intelligence, offering new opportunities for early detection and the standardization of clinical practice.

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